

# UNIT 5: INTEREST & CREDIT

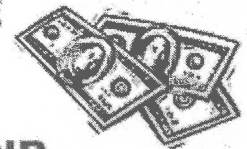
## Part 1 - Interest

Topic	Assignment #	Date
Get Ready p. 3-4		
Simple Interest p. 5-7	1a	
Simple Interest p. 8-9	1b	
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Name: \_\_\_\_\_

Answers

### SIMPLE AND COMPOUND INTEREST



Since this section involves what can happen to your money, it should be of INTEREST to you!



Get Ready

1. How many:

a) months are in a year? 12b) days are in a year? 365c) weeks are in a year? 52

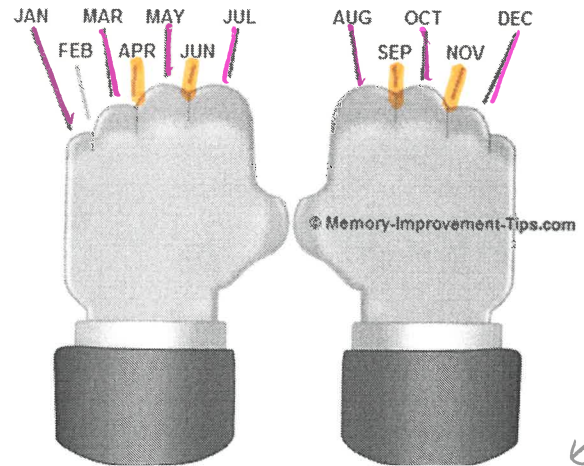
2a. Which months have 30 days?

April September  
June November

b) Which months have 31 days?

January August  
March October  
May December  
July

c) Which month has 28 (sometimes 29) days?

February**Mnemonic for Remembering Which Months Have 31 Days**

  = 31 Days      = 30 Days      = 28 or 29 Days

You can USE YOUR KNUCKLES to remember which months have 31 days!

Here's how: 1) Hold up your fists as shown above. 2) Count the months from left to right, using your knuckles AND the space between each knuckle.

Months ON the knuckles have 31 days. Months BETWEEN the knuckles have 30 days (except February, which has 28 days or 29 on a leap year).

3. Express the following time periods in years (or decimals of a year)

a) 24 months 2b) 26 weeks 0.5(hint: 26 out of 52 weeks;  $\frac{26}{52}$ )c) 6 months 0.5(hint: 6 out of 12 months;  $\frac{6}{12}$ )d) 18 months 1.5e) 1 day 0.003f) April = 0.08

(hint: 1 year = 12 months;

18 - 12 = 6 months  $1 + \frac{6}{12}$  $\frac{1}{365}$  $\frac{30}{365}$ 

g) from your current age until you are 60

age 16 - 42 years  
 ex.  $60 - 17 = 43$ ;  $60 - 18 = 42$ ;  $60 - 16 = 41$

4. List 6 different pairs of whole numbers that multiply to 72.

2 x 36    3 x 24    4 x 18    6 x 12  
8 x 9    72 x 1



Find your number  
Look right next door  
4 or less, just ignore  
5 or more add one more!

5. Calculate then round off to nearest  $100^{\text{th}}$  (2 decimal places):

- Example: Round 14.763 to the nearest hundredth. = 14.76

6 is in the hundredths place value. Look at the number to the right of the 6. Since 3 is less than 5, leave the 6 alone and drop the 3.



- Example: Round 14.768 to the nearest hundredth. = 14.77

6 is in the hundredths place value. Look at the number to the right of the 6. Since 8 is "5 or greater", change the 6 to a 7 and drop the 8.



- Example: Round 14.765 to the nearest hundredth. = 14.77

6 is in the hundredths place value. Look at the number to the right of the 6. Since 5 is "5 or greater", change the 6 to a 7 and drop the 5.



a)  $32 \div 46$  0.70    b)  $71 \div 45$  1.58    c)  $31 \div 9$  3.44    d)  $\$45 \div 2$  \$22.50

(Remember - cents are always expressed with two decimal places - no more; no less)

0.695    1.577    3.444    22.5

5. Express each percent as a decimal number. (Move the decimal two places to the left or divide by 100.)

a) 100% 1    b) 10% 0.1    c) 1% 0.01    d) 0.1% 0.001

e) 29.9% 0.299    f) 19.5% 0.195    g) 0.25% 0.0025    h) 0% 0

g)  $19\frac{1}{2}\% = 19.5\% = 0.195$

6. Calculate (multiply the decimal form of the percent by the number). How many can you do without a calculator? (ie 1% - move decimal two places to left; 2% - calculate 1% then multiply by 2; 10% - move decimal 1 place to left; 25% - divide by 4; 50% - divide by 2; etc.)

a) 1% of \$300 \$3    b) 2% of \$300 \$6    c) 5% of \$100 \$5    d) 10% of \$500 \$50  
e) 20% of \$7000 \$1400    f) 25% of \$400 \$100    g) 50% of \$7000 \$3500

If using a calculator, convert % to decimal then multiply by number.

## Lesson 1 – Simple Interest

**Interest is the amount paid for using money.** When you invest money, you are able to **earn interest** on your investment. (The financial institution pays you interest for borrowing your money). When you repay a loan, you must **pay interest** in addition to the amount you originally borrowed. In this lesson we will explore the **most basic** kind of interest, called simple interest. Simple interest is paid on the **principal only** (on the original amount invested or borrowed), not on an amount that includes interest already charged.

### What is interest?

Interest is money earned on an investment or a fee paid for borrowing money.

When is interest 'good' ☺?

When paid to you on your investment  
(financial institution is borrowing your money)

When is interest 'bad' ☹?

When you pay interest for money you borrow

### SIMPLE INTEREST FORMULA

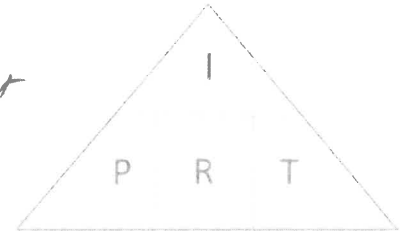
$$I = PRT$$

I - Interest on original investment  
(on principal) or loan

P - PRINCIPAL (original amount borrowed or invested)

R - annual yearly interest RATE (change % to decimal → ÷ 100)

T - length of TIME of investment or loan (in years)



$$P = \frac{I}{RT}$$

$$R = \frac{I}{PT}$$

$$T = \frac{I}{PR}$$

Cover the variable you want to find.

**Example 1:** You deposit \$5000 into a bank account for 3 years collecting *simple interest* at 7%.

a) How much interest would you earn?

First, fill in the values for the variables (letters) required in the equation.

$$I = \underline{\quad ? \quad}$$

$$P = \underline{5000}$$

$$R = \underline{0.07} \text{ (decimal } \rightarrow \div 100)$$

$$T = \underline{3}$$

Second, place those values in the corresponding spot in the equation. Finally, solve for the unknown variable.

$$I = PRT$$

$$I = (5000)(0.07)(3)$$

$$I = \underline{\$1050}$$

b) at the end of 3 years  $5000 + 1050$   
Total = Principal + interest = \$6050.

~~Example 1: How much money would you have at the end of 3 years?~~

Example 2: You borrow \$3000 from a bank that charges simple interest at 8% per year. If it takes 6 months to repay the loan, how much interest will you be charged?

$I = \underline{\quad ? \quad}$        $P = \underline{3000}$        $R = \underline{0.08}$        $T = \underline{\frac{6}{12} = 0.5}$

(If time is in months, divide by 12 to convert into decimal of a year.)

$$I = PRT$$

$$I = (3000)(0.08)(0.5)$$

$$I = \underline{\$120}$$

### ASSIGNMENT #1a – Show all work where possible

1. State each as a fraction (or decimal) of a year.

(round off: if # in 3rd decimal place is 5 or more, add 1 to # in 2nd decimal place)

a) 8 months =  $\frac{8}{12} = \underline{0.75}$

b) 200 days =  $\frac{200}{365} = \underline{0.55}$

c) 13 weeks =  $\frac{13}{52} = \underline{0.5}$

d) 60 weeks =  $\frac{60}{52} = \underline{1.15}$

e) 3 months =  $\frac{3}{12} = \underline{0.25}$

f) 404 days =  $\frac{404}{365} = \underline{1.11}$

2. Find the simple interest in each case. Remember, **TIME is always in YEARS.**

(months  $\div 12$ ; weeks  $\div 52$ ; days  $\div 365$ ). Remember **cents is only two decimal places**. Round off.

Calculate all at once on your calculator. *Interest answer should have dollars sign.*

	Principal	Rate	Time	Interest ( $I=PRT$ )
a)	\$1,278	9%	2 years	$I = (1278)(0.09)(2)$ $I = \underline{\$230.04}$

b)	\$1,400	16%	6 months	$I = (1400)(0.16)(\frac{6}{12} = 0.5)$ $I = \underline{\$112}$
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(hint: 6 months as decimal of year =  $\frac{6}{12} = 0.5$ )

c)	\$920	8½ %	26 weeks	$I = (920)(0.085)(\frac{26}{52} = 0.5)$ $I = \underline{\$39.10}$
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$\frac{26}{52} = 0.5$        $8.5\% = 0.085$

d)	\$2,200	7¼ %	200 days	$I = (2200)(0.0725)(\frac{200}{365} = 0.55)$ $I = \underline{\$87.73}$
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$7\frac{1}{4}\% = 7.25\% = 0.0725$   
 $\frac{200}{365} = 0.55$

## Lesson 1 – Simple Interest (continued)

### Calculating P, R, & T.

Use the **formula triangle** (p. 2) for simple interest to rearrange the formula so we can calculate:

$$P = \frac{I}{RT}$$

$$R = \frac{I}{PT}$$

$$T = \frac{I}{PR}$$

**Example 1:** ~~Mike~~ <sup>Nadya</sup> deposited \$3000 into a savings account with a simple interest at 7% per annum (year). Calculate the number of days the money was in the account if it earned \$240 in interest.

Fill in the given values for the variables

$$I = \underline{240} \quad P = \underline{3000} \quad R = \underline{0.07} \quad T = \underline{?}$$

Write the Formula in terms of T

$$T = \frac{I}{PR}$$

Substitute and solve  
(include units  
in answer -  
years)

$$= \frac{240}{(3000)(0.07)} = \frac{240}{210} = 1.1428 \text{ years.}$$

Since time is in years, change the above answer to be in days to answer the question. *(multiply decimal by 365)*  
 $1 \text{ year} + 0.1428 \text{ of a year.} \quad (0.1428)(365) = 52.122$   
 $= 365 + 52 = 417 \text{ days.}$

**Example 2:** John borrowed \$5000 from his grandma. At the end of 3 years he owed her \$675 in simple interest. What rate did his grandma give him for the loan?

Fill in the given values for the variables

$$I = \underline{675} \quad P = \underline{5000} \quad R = \underline{?} \quad T = \underline{3}$$

Write the Formula in terms of R

$$R = \frac{I}{PT}$$

Substitute and solve

$$= \frac{675}{(5000)(3)} = \frac{675}{15000} = 0.04$$

Since rate is usually given as a percentage, change the above answer from a decimal to a percent.

$$4\%$$

**ASSIGNMENT #1b** – Show all work where possible (ie, formula, substituted values and answers). ~~Hand in the entire booklet when you have completed all notes and assignments in the booklet.~~ Round your answers to two decimal places.

1. Howie Doing has a savings account at Mon-E Credit Union in Winnipeg. Howie deposits \$2000 into a savings account that pays 3% simple interest per annum.

- a) Calculate the interest that Howie will earn on his savings after 2 years. Follow all the steps of using a formula from page 6.

$$I = \underline{\quad ? \quad} \quad P = \underline{2000} \quad R = \underline{0.03} \quad T = \underline{2}$$

$$I = \underline{PRT} \quad (\text{formula})$$

$$I = ( \underline{2000} ) ( \underline{0.03} ) ( \underline{2} ) \quad (\text{substitute})$$

$$I = \underline{\$120} \quad (\text{answer with dollar sign})$$



- b) How much money will Howie have in his account after 2 years if he doesn't make any withdrawals?

$$\begin{aligned} \text{Total} &= \text{Principal} + \text{Interest} \\ &= \underline{2000} + \underline{120} \\ &= \underline{\$2120} \quad (\text{answer with dollar sign}) \end{aligned}$$

2. Solve the following problems using the simple interest formula.

- a) If the interest earned on a deposit is \$50, and the interest rate is 3.5% per annum invested for 4 years, what is the principal? (remember to round to the nearest cent)

$$I = \underline{50} \quad P = \underline{\quad ? \quad} \quad R = \underline{0.035} \quad T = \underline{4}$$

$$P = \underline{\frac{I}{RT}} \quad (\text{formula})$$

$$= \frac{(\underline{50})}{(\underline{0.035})(\underline{4})} = \frac{(\underline{50})}{(\underline{0.14})}$$

$$= \underline{\$357.14} \quad (\text{answer with dollar sign})$$

rounded to  
nearest cent



- b) How many years does it take to earn \$180 interest on an investment if the principal is \$5000 and the interest rate is 2% per annum?

$$I = \underline{180} \quad P = \underline{5000} \quad R = \underline{0.02} \quad T = \underline{?}$$

$$T = \frac{I}{PR}$$

$$= \frac{(\underline{180})}{(\underline{5000})(\underline{0.02})} = \frac{(\underline{180})}{(\underline{100})}$$

$$= \underline{1.8 \text{ years}}$$

- c) Calculate the annual interest rate on an investment if the principal is \$4000 and the interest is \$120 earned over three years. **Answer as a decimal and a percent.**

$$I = \underline{120} \quad P = \underline{4000} \quad R = \underline{?} \quad T = \underline{3}$$

$$R = \frac{I}{PT}$$

$$= \frac{(\underline{120})}{(\underline{4000})(\underline{3})} = \frac{(\underline{120})}{(\underline{12000})}$$

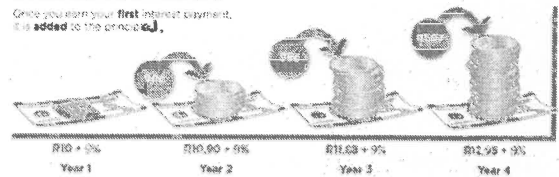
$$= \underline{0.01} \text{ (decimal)}$$

$$\text{Rate (as a percent)} = \frac{\underline{0.01}}{\text{(rate as a decimal)}} \times 100 = \underline{1\%}$$

You may want to include this formula and how to use it on your resource sheet including how to find the time and the percent, if you need a reminder.

## What is compound interest?

The basic principle of compound interest is earning **additional interest on interest**.  
Once you earn your first interest payment, it is added to the principal.



## Lesson 2 – Compound Interest

**Simple Interest** – interest is only calculated **ONCE** over the length of a TERM. It is calculated from the original amount invested or borrowed.

**Compound Interest** – interest is calculated **SEVERAL** times over a TERM. It is calculated on an amount that includes interest already charged. The interest from each time period is added to the principal. As the principal grows, the rate at which you earn (or pay) interest grows because you're earning (or paying) "interest on interest".

For Example:

- \$4,000 is deposited at 6% for 2 years at simple interest. Here interest is found only once, at the end using  $I = PRT$ .

$$I = (4000)(0.06)(2)$$

$$I = \$480$$

Total Amount =  
~~at the end of 2 years~~

$$4000 + 480 = \$4480$$

- \$4,000 can also be put into a bank that pays interest at 6% over two years that is COMPOUNDED one of several ways:

1. Semi-annually \_\_\_\_\_
2. Quarterly \_\_\_\_\_
3. Monthly \_\_\_\_\_
4. Weekly \_\_\_\_\_
5. Daily \_\_\_\_\_

We will calculate \$4,000 compounded semi-annually for 2 years at 6% using a table to see what the total amount will be.

*Portion of year*

Period (yrs)	Principal	Rate	Time	Interest (PRT)	Balance
0					\$4000.00
0.5	\$4000	0.06	0.5	$(4000)(0.06)(0.5) = \$120.00$	\$4120
1	\$4120	0.06	0.5	$(4120)(0.06)(0.5) = \$123.60$	\$4243.60
1.5	\$4243.60	0.06	0.5	$(4243.60)(0.06)(0.5) = \$127.31$	\$4370.91
2	\$4370.91	0.06	0.5	$(4370.91)(0.06)(0.5) = \$131.12$	\$4502.04

*halfway thru year*  
*1 year mark*  
*1 1/2 year mark*  
*2 years*

How much more interest is earned when compounded semi-annually over 2 years as compared to when calculated with simple interest over 2 years?

$$\$4502.04 - 4480 = \$22.04$$

**ASSIGNMENT #2** : Use the compound interest tables provided to calculate the total amount at the end of each term:

- 1) \$10,000 invested at 8% for 3 years, compounded ANNUALLY.  $\frac{1 \times \text{year}}{= \$12\,597.12}$

Period	Principal	Rate	Time	Interest (PRT)	Balance
0					\$10 000
1	\$ 10 000	0.08	1	$(10\,000)(0.08)(1) = 800$	\$10 800
2	\$10 800	0.08	1	$(10\,800)(0.08)(1) = 864$	\$11 664
3	\$11 664	0.08	1	$(11\,664)(0.08)(1) = 933.12$	\$12 597.12

- 2) \$7,500 invested at  $9\frac{1}{2}\%$  for 1 year, compounded QUARTERLY.  $= 9.5\% = 0.095, 4 \times \text{year} = \$8238.30$

Period	Principal	Rate	Time	Interest (PRT)	Balance
0			$\frac{\text{portion of year}}{4 \times \text{year}}$		\$7 500
0.25	\$ 7 500	0.095	0.25	$(7500)(0.095)(0.25) = 178.13$	\$ 7 678.13
0.5	\$ 7 678.13	0.095	0.25	$(7678.13)(0.095)(0.25) = 182.86$	\$ 7 860.49
0.75	\$7 860.49	0.095	0.25	$(7860.49)(0.095)(0.25) = 186.69$	\$ 8 047.18
1	\$8 047.18	0.095	0.25	$(8047.18)(0.095)(0.25) = 191.12$	\$ 8 238.30

- 3) \$12,250 invested at  $5\frac{1}{4}\%$  for one and a half years, compounded SEMI ANNUALLY.  $5.25\% = 0.0525 = \$13\,240.26$

Period	Principal	Rate	Time	Interest (PRT)	Balance
0					\$12 250
0.5	12 250	0.0525	0.5	$(12250)(0.0525)(0.5) = 321.56$	\$ 12 571.56
1	12 571.56	0.0525	0.5	$(12571.56)(0.0525)(0.5) = 330.03$	\$12 901.59
1.5	12 901.59	0.0525	0.5	$(12901.59)(0.0525)(0.5) = 338.67$	\$ 13 240.26

**Compound interest** can be found by using a **table** (as in the last assignment) or using a **formula**.

Here is the formula for compound interest:

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

A = Final Amount (principal + interest)    n = NUMBER of interest periods a year  
P = PRINCIPAL (amount invested or borrowed)    t = length of Time in years  
r = annual (yearly) RATES of interest - decimal form

It is a good idea to include this formula on your resource sheet, and perhaps a note of how to use calculator to find answer.

**ASSIGNMENT #3** – Calculate the amount at the end of the given time period for each of the following investments: (show your work on the next 2 pages)

	Principal	Annual Rate	Interest Compounded	Time	Amount
a)	\$500	8%	annually $n=1$	2 yrs	\$583.20
b)	\$1000	10%	semi-annually $n=2$	3 yrs	\$1340.10
c)	\$600	10%	annually $n=1$	10 yrs	\$1556.25
d)	\$400	12%	semi-annually $n=2$	2 yrs	\$504.99
e)	\$800	10%	quarterly $n=4$	2 yrs	\$974.72

Number of compounding periods	explanation	Value of n
annually	1 time a year	1
semi-annually	2 times a year (or at each half)	2
quarterly	4 times a year	4
bi-weekly	every 2 weeks	26
weekly	every week	52
daily	every day	365

To calculate  $(1.06)^3$  on your calculator, press  $\boxed{1.06}$ , then  $\boxed{y^x}$ , then  $\boxed{3}$ .



The value  $5000\left(1 + \frac{0.06}{1}\right)^{1 \times 3}$  may be calculated directly on your scientific or graphing calculator as follows:

$$5000 \times (1 + 0.06 \div 1) y^x (1 \times 3) =$$

Worksheet for Compound Interest – using a formula

a)  $P = \underline{500}$   $n = \underline{1}$   $r = \underline{0.08}$   $t = \underline{2}$

$$A = P \left(1 + \frac{r}{n}\right)^{nt} = 500 \left(1 + \frac{0.08}{1}\right)^{(1)(2)}$$

$$= 500 (1 + 0.08)^2$$

$$= 500 (1.08)^2$$

$$= 583.20$$

You can calculate this all at once on your calculator, using brackets and the exponent button (see above).

b)  $P = \underline{1000}$   $n = \underline{2}$   $r = \underline{0.10}$   $t = \underline{3}$

$$A = P \left(1 + \frac{r}{n}\right)^{nt} = 1000 \left(1 + \frac{0.10}{2}\right)^{(2)(3)}$$

$$= 1000 (1 + 0.05)^6$$

$$= 1000 (1.05)^6$$

$$= 1340.10$$

c)  $P = \underline{600}$   $n = \underline{1}$   $r = \underline{0.10}$   $t = \underline{10}$

$$A = P \left(1 + \frac{r}{n}\right)^{nt} = 600 \left(1 + \frac{0.10}{1}\right)^{(1)(10)}$$

$$= 600 (1 + 0.1)^{10}$$

$$= 600 (1.1)^{10}$$

$$= 1556.25$$

~~$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$~~

d)  $P = \underline{400}$   $n = \underline{2}$   $r = \underline{0.12}$   $t = \underline{2}$

$$\begin{aligned} A &= P \left( 1 + \frac{r}{n} \right)^{nt} = 400 \left( 1 + \frac{0.12}{2} \right)^{(2)(2)} \\ &= 400 (1 + 0.06)^4 \\ &= 400 (1.06)^4 \\ &= \$504.99 \end{aligned}$$

e)  $P = \underline{800}$   $n = \underline{4}$   $r = \underline{0.10}$   $t = \underline{2}$

$$\begin{aligned} A &= P \left( 1 + \frac{r}{n} \right)^{nt} = 800 \left( 1 + \frac{0.10}{4} \right)^{(4)(2)} \\ &= 800 (1 + 0.025)^8 \\ &= 800 (1.025)^8 \\ &= \$974.72 \end{aligned}$$

### The Effect of Compounding Frequency

a) If Ania invests \$5000 in a financial institution at 6% per year compounded annually for a period of 3 years, calculate his total amount at the end of three years using the compound interest formula. Then calculate the total interest earned in 3 years.

(Hint: To calculate the amount of Interest (I) earned, subtract the Principal (P) from the calculated amount (A).)

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{n}\right)^{nt} \\
 &= 5000 \left(1 + \frac{0.06}{1}\right)^{(1)(3)} \\
 &= 5000 (1.06)^3 \\
 &= \$5955.08
 \end{aligned}$$

Interest  
over  
3 years

$$\begin{aligned}
 &= 5955.08 \\
 &\quad - 5000 \\
 &= \$955.08
 \end{aligned}$$

b) If Ania invests \$5000 in a financial institution at 6% per year compounded quarterly for a period of 3 years, calculate his interest at the end of three years using the compound interest formula.

$$\begin{aligned}
 A &= P \left(1 + \frac{r}{n}\right)^{nt} \\
 &= 5000 \left(1 + \frac{0.06}{4}\right)^{(4)(3)} \\
 &= 5000 (1.015)^{12} \\
 &= 5000 (1.015)^{12} \\
 &= \$5978.09
 \end{aligned}$$

Interest  
over  
3 years

$$\begin{aligned}
 &= 5978.09 - 5000 \\
 &= \$978.09
 \end{aligned}$$

Note that the investment compounded **quarterly** (4 times a year) earns interest of \$978.09, while the investment compounded **annually** earns interest of \$955.08. When the interest is compounded quarterly, it is reinvested into the principal **more often**. Since the **principal grows more frequently**, the **final investment is worth more**. In general, the **more often an investment is compounded, the greater the amount of interest it earns**. When borrowing or investing money from a financial institution, it is important to **consider not only the interest** the institution offers, but **how often the interest is compounded**.

## Lesson 4 - Rule of 72

**RULE OF 72** – This is a quick way to **estimate** the amount of years and annual interest rate it takes for an investment to double when compounded annually.

<b>FORMULA</b>	$rt = 72$
[Interest Rate (%)]	X [# of years] = 72

*Do not change  
to decimal*

Write the above formula in terms of the # of years:

# of years for an investment to double = $\frac{72}{\text{interest rate (\%)}}$ $t = \frac{72}{r}$
---

Ex. 1 If you invest \$100 at 1% interest, it would take 72 years for it to double (i.e. you would have \$200)

$$\frac{72}{1}$$

Ex. 2 If you invest \$100 at 2% interest, it would take 36 years for it to double (i.e. you would have \$200)

$$\frac{72}{2}$$

Ex. 3 If you invest \$100 at 3% interest, it would take 36 years for it to double (i.e. you would have \$200)

$$\frac{72}{3}$$

Ex. 4 If you invest \$100 at 3% interest, it would take 72 years for it to **quadruple** (i.e. you would have \$400)

$$\frac{72}{3} = 36 \text{ (double)}$$

$$36 \times 2 = 72 \text{ (quadruple)}$$



Write the above formula in terms of the interest rate:

$$\text{Interest Rate (as a \%)} = \frac{72}{\# \text{ years}}$$

$$r = \frac{72}{t}$$

Ex 5 If you invest \$100 for 8 years, the interest rate would need to be approximately  $72 \div 8 = 9 \text{ years}$  for you to double your money?

Include these formulas of rule of 72 on your resource sheet. Remember to include that you only use this formula when interest is **compounded annually**.

#### ASSIGNMENT #4

1. Using the rule of 72, how many years would it take your investment to double at the following rates which are compounded annually?

a) 10%  $\frac{72}{10} = 7.2$

e) 8%  $\frac{72}{8} = 9$

b) 9%  $\frac{72}{9} = 8$

f) 2%  $\frac{72}{2} = 36$

c) 4%  $\frac{72}{4} = 18$

g) 12%  $\frac{72}{12} = 6$

d) 6%  $\frac{72}{6} = 12$

h) 3%  $\frac{72}{3} = 24$

2. Using the rule of 72, how many years would it take your investment to **quadruple** at the following rates which are compounded annually?

a) 8%  $\frac{72}{8} = 9$   $9 \times 2 = 18$

c) 12%  $\frac{72}{12} = 6$   $6 \times 2 = 12$

b) 9%  $\frac{72}{9} = 8$   $8 \times 2 = 16$

d) 1%  $\frac{72}{1} = 72$   $72 \times 2 = 144$

3. What percent interest, compounded annually, would cause the following to occur?

Initial Investment	Interest Rate	Number of Years	Final Amount
\$1000	$\frac{72}{12} = 6\%$	12	\$2000
\$4000	$\frac{72}{9} = 8\%$	9	\$8000
\$500	$\frac{72}{24} = 3\%$	24	\$1000

$$rt = 72$$

$$r = \frac{72}{t}$$

How to build Wealth: Make more than you spend and invest the difference wisely.

### Deciding How to Invest

As you may have guessed, investing your money is an easy way to increase the amount of money you have. Banks offer a number of different options for investing, so it is important to compare them and decide what is best for you based on your financial goals.

**Risk** is the chance that you take that all or part of the money you put in an investment can be lost. It is the chance that you take that an investment will lose money or that one investment will earn less than another.

### High-Risk Investments

High-risk investments are investments that may increase or decrease in value very rapidly. The bigger the risk, the bigger the 'potential payoff'. These investments may produce a large return, but this is not guaranteed. There is the risk that you may lose some or most of the money you invested. An example of a high-risk investment is the stock market.

### Low-Risk Investments

You may have a low-risk investment already! If you have a savings account or a chequing account that pays interest, then you have a low-risk investment. A low-risk investment is one where you **will not likely lose any of the money you invest**. Your investment will grow reliably and slowly. For example, money deposited into a savings account will be safe, and will pay **small amounts of interest** into your account on a regular basis.

"Rule No. 1: Never lose money. Rule No. 2: Never forget rule No. 1."-Warren Buffett

Don't take unnecessary risks. If you think of risk like a pyramid – the greater the risk, the higher up the pyramid it goes, and the less money should be entrusted to it. **Invest only what you can afford to lose.** \*

### Put time to work for you.

When you are young, your greatest financial asset is time. The younger you start investing, the more you can reap the benefits of compounding and long-term market gains. The more time you have to save and invest, the more money you can end up with. Invest as much as you can as soon as you can to get the time value of money working for you. Every little bit helps. Growing your money is like picking a school for your post-secondary education – it's an important investment in your future that you need to devote time and research to. The first step is to educate yourself about all the possible money-growing paths available to you.

*"Someone who puts \$4,000 a year into retirement accounts starting at 22 can have \$1 million by age 62, assuming 8% average annual returns. Wait 10 years to start contributing, and you'd have to put in more than twice as much – \$8,800 a year – to reach the same goal."*

## Assignment: Interest

**Note to Students:** Have you made a resource sheet for this module? Do you have the definitions and formulas on your resource sheet? If so, you should use it now. If not, now would be a good time to make one.

1. Gale Storm invests \$5000 in her financial institution. Calculate the amount of interest she will earn if she invests the money for  $3\frac{1}{2}$  years at a simple interest rate

of  $5\frac{3}{4}\%$ . (1 mark)

$$I = P R T$$
$$= (5000)(0.0575)(3.5)$$

$$I = \$1006.25$$

2. Fill in the blanks in the following chart. (6 marks – one for each blank)

Interest	Principal	Rate	Time
\$160.00	\$1000	8%	<u>2</u> years
\$510.00	\$1120.88	6.5%	7 years
\$342.53	\$5000	25%	100 days $\frac{100}{365}$
\$43.50	\$800	9%	<u>221</u> days
\$14.00	1461.38	7%	50 days $\frac{50}{365}$
\$150.00	\$2000	25%	4 months $\frac{4}{12} =$

$$\begin{aligned} R &= \frac{I}{P_T} \\ &= \frac{342.53}{(5000)(0.2739)} \\ &= \frac{342.53}{1369.5} \\ &= 0.25 \\ &= 25\% \end{aligned}$$



$$P = \frac{I}{rt} = \frac{510}{(0.065)(7)} = \frac{14}{(0.07)(0.136)}$$
$$= \frac{510}{0.455} = \frac{14}{0.00958}$$
$$= 1120.88 = 1461.38$$

$$T = \frac{I}{PR} = \frac{160}{(1000)(0.08)} = \frac{43.50}{800(0.09)} = \frac{43.50}{72} = 0.6 \text{ years}$$

$$(0.6)(365) = 221 \text{ days}$$

$$7) \frac{14}{(0.07)(0.126)} = \frac{14}{0.00882} = 1588.54$$

$$R = \frac{I}{PT}$$
$$= \frac{150}{(2000)(0.3)}$$
$$= \frac{150}{600}$$
$$= 0.25 = 25\%$$

3. A principal of \$2000 is invested for two years at 10 percent compounded semi-annually. Complete the following chart to calculate the interest earned. (5 marks)

Interest Period		$I = Prt$	Amount
0		—	\$ 2000
1	0.5	$(2000)(0.10)(0.5) = 100$	\$ 2100
2	1	$(2100)(0.10)(0.5) = 105$	\$ 2205
3	1.5	$(2205)(0.10)(0.5) = 110.25$	\$ 2315.25
4	2	$(2315.25)(0.10)(0.5) = 115.76$	\$ 2431.01

4. a) Using the compound interest formula, solve question 3. (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 2000\left(1 + \frac{0.10}{2}\right)^{(2)(2)} = 2000(1.05)^4 = \$2431.01$$

- b) Is your answer the same using the chart and the compound interest formula? (1 mark)

yes.

5. Using the compound interest formula, calculate both the value of the investment and the interest earned after the given time periods.

- a) \$4000.00 for five years at 7% compounded semi-annually (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 4000\left(1 + \frac{0.07}{2}\right)^{(2)(10)} = 4000(1.035)^{20} = \$7959.16$$

- b) \$600.00 for 10 years at 9% compounded monthly (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 600\left(1 + \frac{0.09}{12}\right)^{(12)(10)} = 600(1.0075)^{120} = \$1470.81$$

- c) \$2500.00 for two years at 8% compounded daily (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 2500\left(1 + \frac{0.08}{365}\right)^{(365)(2)} = 2500(1.000219178)^{730} = \$2933.73$$

d) \$100,000.00 for four years at 12% compounded quarterly (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 100\,000 \left(1 + \frac{0.12}{4}\right)^{(4)(4)} = 100\,000 (1.03)^{16} = \$160\,470.64$$

e) \$900.00 for eight years at 10% compounded annually (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 900 \left(1 + \frac{0.10}{1}\right)^{(1)(8)} = 900 (1.10)^8 = \$1929.23$$

6. Flo East has  $\$25,000$  to invest in a financial institution for a period of three years. Institution A offers her an interest rate of 6% compounded annually. Institution B offers her an interest rate of 6% compounded monthly. Using the compound interest formula, determine which financial institution would pay her more interest, and by how much. (3 marks)

(A)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 25\,000 \left(1 + \frac{0.06}{1}\right)^{(1)(3)} = 25\,000 (1.06)^3 = 25\,000 (1.191016) = \$29\,775.40$$

(B)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 25\,000 \left(1 + \frac{0.06}{12}\right)^{(12)(3)} = 25\,000 (1.005)^{36} = 25\,000 (1.196680515) = \$29\,917.01$$

$$29\,917.01 - 29\,775.40 = \$141.61$$

7. Senta Cash invests \$350 at 6% compounded annually.

a) Use the rule of 72 to estimate how many years it will take her investment to double in value. (1 mark)

$$\frac{72}{6} = 12 \text{ years.}$$

b) Use the compound interest formula to determine the actual value of \$350 at 6% compounded annually for the number of years indicated in part (a). (1 mark)

$$I = P\left(1 + \frac{r}{n}\right)^{nt} = 350 \left(1 + \frac{0.06}{1}\right)^{(1)(12)} = 350 (1.06)^{12} = \$704.27$$

c) Determine the difference between the actual value of the investment and the doubled value found with the rule of 72. (1 mark)

$$704.27 - 700 = \$4.27$$

